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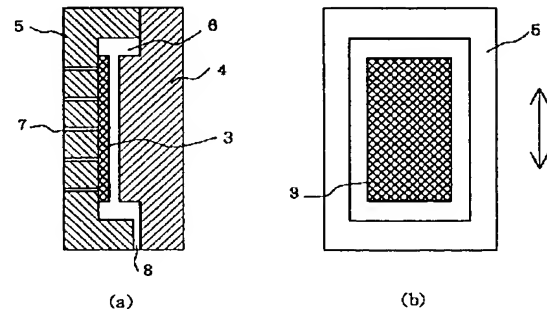
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(54) 【発明の名称】 複合射出成形物及びその製造方法

(57) 【要約】

【課題】 薄肉で特にウェルド部の強度が優れておりかつ樹脂の配向方向による強度のバラツキが少ない射出成形物及びその製造方法を提供すること。

【解決手段】 一方向に連続な強化繊維を含む熱可塑性樹脂シートを閉じた金型の内面に予め固定し、該金型内に熱塑性樹脂を射出して複合射出成形物を成形する。



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Bibliography

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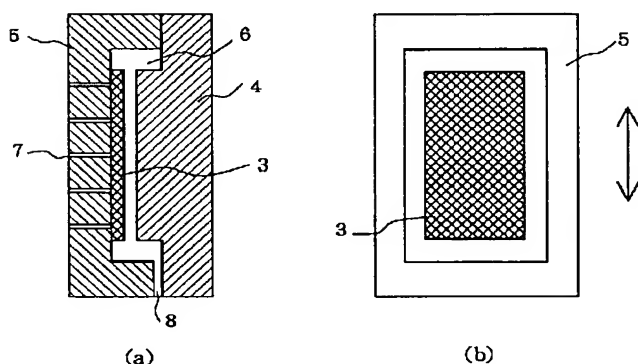
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## (57) [Abstract]

[Technical problem] The reinforcement of the weld section is excellent in especially thin meat, and offer the injection-molding object with little variation and its manufacture method of the reinforcement by the direction of orientation of resin.

[Means for Solution] It fixes to an inner surface of metal mold which closed a thermoplastics sheet containing consolidation fiber [ \*\*\*\* / an one direction ] beforehand, and in this metal mold, thermoplastic resin is injected and a compound injection-molding object is fabricated.

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## CLAIMS

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[Claim(s)]

[Claim 1] A compound injection-molding object which is the sheet which carried out the laminating of a thermoplastics sheet or it containing consolidation fiber [ \*\*\*\* / an one direction ], and a consolidation sheet and thermoplastics 1000 micrometers or less come for thickness to unify.

[Claim 2] A compound injection-molding object of claim 1 which a consolidation sheet is in the interior of thermoplastics, and it comes to unify.

[Claim 3] A compound injection-molding object of claim 1 whose thickness of the thinnest portion is 1mm or less.

[Claim 4] A compound injection-molding object of claims 1 or 2 which the laminating of the facing is carried out to a front face of a sheet which carried out the laminating of a thermoplastics sheet or it, and it comes to unify.

[Claim 5] A compound injection-molding object of claims 1 or 2 whose thermoplastics is polystyrene system resin, polyethylene system resin, a polypropylene resin, or polyvinyl chloride resin.

[Claim 6] A compound injection-molding object of claims 1 or 2 whose consolidation fiber

is a glass fiber.

[Claim 7] A manufacture method of a compound injection-molding object of claim 1 characterized by fixing to an inner surface of metal mold with which it is the sheet which carried out the laminating of a thermoplastics sheet or it containing consolidation fiber [ \*\*\*\* / an one direction ], and thickness closed a consolidation sheet 1000 micrometers or less beforehand, and injecting thermoplastics in this metal mold.

[Claim 8] Fix to an inner surface of metal mold with which it is the sheet which carried out the laminating of a thermoplastics sheet or it containing consolidation fiber [ \*\*\*\* / an one direction ], and thickness closed a consolidation sheet 1000 micrometers or less beforehand, and thermoplastics is injected in this metal mold. A manufacture method of a compound injection-molding object of claim 2 which carries out the laminating of the thermoplastics to one consolidation sheet side, and is characterized by preparing space closed between metal mold an another side side of a consolidation sheet by subsequently moving some metal mold, and injecting thermoplastics to this space.

[Claim 9] A manufacture method of claims 7 or 8 with a grain direction of an outermost layer of drum almost parallel to a flow direction of resin in metal mold in contact with resin by which a sheet which carried out the laminating of a thermoplastics sheet or it is injected.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the injection-molding object and the injection-molding method that the thermoplastics sheet containing the consolidation fiber arranged in the one direction and thermoplastics were unified.

[0002]

[Description of the Prior Art] In recent years, the thermoplastics manufactured by the injection-molding method is advancing towards the formation of light-gage lightweight as well as high intensity. The light and high intensity product [ of the laptop type especially in the personal computer industry ] housing is demanded. However, if it is in an injection-molding method, reinforcement falls remarkably by avoiding and carrying out the thinning of reinforcement falling according to generating of that the engine performance on the strength changes by the orientation of the resin at the time of shaping, or a weld line.

[0003] Generally for the object of high-intensity-izing of a product, the thermoplastics which contains consolidation fiber as a molding material is used. However, generally, although an about 10mm thing is used from several microns, when fiber length is short, the reinforcement of the moldings obtained is inadequate [ in order to make homogeneity fill up with the resin which contains fiber in a mold, fiber needs to be a staple fiber, and / fiber length ] in the thermoplastics containing the consolidation fiber for injection molding. Even if it uses the resin pellet which has about 10mm fiber, it is cut in the process kneaded with a screw, and becomes short till around 1mm, and the early age strength held with the pellet decreases remarkably. Moreover, since a fluidity is remarkably inferior compared with the material which does not contain fiber, the thermoplastics containing fiber has the problem that light-gage shaping is difficult. Furthermore, uniform distribution of consolidation fiber is disturbed by resin floating, and it is easy to generate the variation in the reinforcement within a moldings. Moreover,

even if it used the resin containing such fiber, the variation in the reinforcement by the orientation accompanying formation of a weld line and floating of resin was unavoidable, carried out the padding of this portion, or had the problem that a configuration had to be changed.

[0004]

[Problem(s) to be Solved by the Invention] The object of this invention is offering the injection-molding object which was excellent in reinforcement, and its manufacture method. Other objects of this invention are offering the injection-molding object in which is thin meat and reinforcement's was excellent, and its manufacture method.

Furthermore, other objects of this invention are that the variation in the reinforcement by the direction of orientation of resin offers the injection-molding object in which the reinforcement of the weld section was excellent few again, and its manufacture method.

[0005]

[Means for Solving the Problem] this invention person completed a header and this invention for reinforcement of a composite molding object which a fiber consolidation thermoplastics sheet and thermoplastics containing consolidation fiber [ \*\*\*\* / an one direction ] of thin meat were injection molded, and was unified being very large wholeheartedly as a result of examination.

[0006] Namely, a compound injection-molding object which this invention is the sheet which carried out the laminating of a thermoplastics sheet or it containing consolidation fiber [ \*\*\*\* / an one direction ], and a consolidation sheet and thermoplastics 1000 micrometers or less come for thickness to unify, It fixes to an inner surface of metal mold with which it is the sheet which carried out the laminating of a thermoplastics sheet or it containing consolidation fiber [ \*\*\*\* / an one direction ], and thickness closed a consolidation sheet 1000 micrometers or less beforehand. It fixes to an inner surface of metal mold with which it is the sheet which carried out the laminating of a thermoplastics sheet or it containing consolidation fiber [ \*\*\*\* / a manufacture method of the compound injection-molding object concerned and an one direction which are characterized by injecting thermoplastic resin in this metal mold ], and thickness closed a consolidation sheet 1000 micrometers or less beforehand. Inject thermoplastics in this metal mold and



the laminating of the thermoplastics is carried out to one consolidation sheet side. Subsequently, it is the manufacture method of the compound injection-molding object concerned characterized by preparing space closed between metal mold and another side of a consolidation sheet, and injecting thermoplastics to this space by moving some metal mold.

[0007]

[Embodiment of the Invention] This invention is explained in details below. The thermoplastics sheet containing consolidation fiber [ \*\*\*\* / the one direction of this invention ] is an one direction fiber reinforcement thermoplastics sheet which it was called [ sheet ] prepreg, and the fiber sheet which lengthened and arranged the continuous fiber with the one direction was used [ sheet ] as the aggregate, and generally carried out impregnation of the thermoplastics to this. The diameter of the size of one fiber is about 3-25 micrometers, and the content is usually 30 to 80 capacity %. The thickness of prepreg is usually 30-500 micrometers.

[0008] Although mentioned as consolidation fiber in metal fibers, such as plastic fiber, such as inorganic fibers, such as a glass fiber and a carbon fiber, a polyamide fiber, polyester fiber, and an aramid fiber, titanium fiber, a boron fiber, and stainless steel fiber, it is not necessarily limited to these. It is a glass fiber preferably as consolidation fiber.

[0009] On the other hand, as thermoplastics made to sink in by the above-mentioned consolidation fiber, although a polystyrene, polyvinyl-chloride, high-density-polyethylene, low-density-polyethylene, polypropylene, polycarbonate, polybutylene terephthalate, and polyether aphone, Pori Sall John, polyether imide (registered trademark "Ultem"), a polyether ether ketone, polyphenylene sulfide, etc. are mentioned, it is not necessarily limited to these. As desirable thermoplastics, they are polystyrene system resin, polyethylene system resin, a polypropylene resin, or polyvinyl chloride resin. Such prepreg can be manufactured by method which is indicated by JP,4-42168,B.

[0010] Even if it may use prepreg independently and carries out two or more sheet laminating, it does not interfere (the prepreg used for this invention or its layered product may be hereafter called a consolidation sheet). However, the thickness needs to be 1000 micrometers or less. Especially the moldings of this invention of the reason is

because in the case of thin meat the feature is demonstrated when thickness is 1mm or less. That is, like the above-mentioned, it shoots and comes out, and in shaping, an anisotropy does not arise about reinforcement by orientation, or the lowering on the strength by generating of a weld line is not avoided. In the case of a thick moldings, although reinforcement with this overall seldom poses a problem since it is large, it serves as a defect fatal especially in the case of a light-gage moldings. However, even if the consolidation sheet was thin in this invention, when this invention person discovered that reinforcement becomes large extremely at a surprising thing when this is made into complex with resin, and it applied to the injection-molding object of thin meat, it found out that the trouble of the conventional injection-molding object was solved. The thickness of a consolidation sheet is 30-1000 micrometers preferably.

[0011] What is necessary is to pile up the prepreg of the number of sheets of arbitration, to carry out heating sticking by pressure and just to cool by the pressure of 0.2-5kg/cm<sup>2</sup>, with the press with which it was equipped with the hot platen heated by the temperature which thermoplastics fuses, in order to carry out the laminating of the prepreg. The grain direction of a laminating sheet can carry out the laminating of other prepreps at an angle of the arbitration of 0 - 90 degrees to the prepreg of the 1st sheet.

[0012] Next, how to manufacture an injection-molding object is explained. First, a consolidation sheet is fixed to the location of the request in metal mold. As for this location, it is effective that it is the portion considered to become the weakest in reinforcement, for example, the part which a weld line and orientation tend to produce. The method of fixing by lengthening immobilization of a consolidation sheet in a vacuum from the vacuum hole prepared in metal mold is mentioned. In this case, if a consolidation sheet is thick, since rigidity is large, it does not stick to metal mold, but when it is difficult to fix and it injects resin, it will pass, or will deform. However, since the thickness of a consolidation sheet is 1000 micrometers or less in this invention, even if there is flexibility, it sticks to metal mold and it injects resin with high voltage in metal mold, it flows, or it hardly deforms. In case the orientation of a consolidation sheet injects resin, it is desirable to arrange so that the direction of the fiber of the outermost-layer-of-drum portion in contact with resin may become almost parallel to the flow

direction of resin. Thus, by arranging, turbulence of the fiber by floating of resin decreases, and the injection-molding object excellent in strong balance is obtained. Subsequently, resin is injected in metal mold from the gate.

[0013] Drawing 1 is an example of the injection-molding object obtained by carrying out in this way, drawing 1 (a) is a front-face side, (b) is a rear-face side, 1 becomes a main part in a gate portion, and 2 has become the fin gate. The rear-face portion of a bottom is compounded with the consolidation sheet 3.

[0014] Drawing 2 is drawing showing the metal mold for fabricating the moldings of drawing 1. On the other hand, metal mold consists of metal mold 4 and another side metal mold 5. Drawing 2 (a) is the front view of the another side metal mold 5 whose (b) are the cross section of metal mold and is a female mold. The space 6 where resin is injected by metal mold, 4, and the another side metal mold 5 on the other hand is formed. The consolidation sheet 3 is stuck to a female mold 5 with the vacuum hole 7, and is fixed. The arrow head in drawing 2 (b) is the direction of the fiber of the layer of the side in contact with the resin of a consolidation sheet. Thus, after fixing a consolidation sheet to the another side metal mold 5, resin is injected to the space 6 in metal mold closed from the gate 8 of a metal mold lower part.

[0015] Drawing 3 is the example which established the gate 8 in the center section of a moldings. By doing in this way, it is possible to shorten floating distance of thermoplastics, to make turbulence of fiber orientation small, and to fabricate.

[0016] By the way, when the consolidation sheet is compounded with one moldings side and the coefficient of linear expansion of a consolidation sheet and thermoplastics differs like [ in drawing 1 -3 ], curvature arises, and the treatment of stress relaxation, such as aging, is required. In order to avoid this, the composite molding object which connoted the consolidation sheet in the center is effective.

[0017] Drawing 4 is drawing showing the metal mold cross section and the shaping method for fabricating the moldings which has such a consolidation sheet in the interior of resin. Metal mold consists of one metal mold 4 and metal mold 5 of another side, and has the two gates 8a and 8b up and down. The metal mold 5 of another side consists of ejector-half 5b in which cover-half 5a and a slide are still more possible. Upper gate 8a

is closed by ejector-half 5b in the state of drawing 4 (a). The consolidation sheet 3 is fixed to metal mold, and space 6a which closed resin from downward gate 8b is made to inject. As shown in drawing 4 (b) after an appropriate time, ejector-half 5b is made to slide and space 6b is made between a consolidation sheet and an ejector half. Moreover, thereby, upper gate 8a is opened by coincidence. And the consolidation sheet shown in drawing 4 (c) can fabricate the moldings in the interior by making resin inject from this open upper part gate.

[0018] Drawing 5 is drawing showing other methods for fabricating the moldings which has a consolidation sheet in the interior of resin. On the other hand in drawing 5, the consolidation sheet 3 is put between metal mold 4 and the another side metal mold 5, and the space 6a and 6b closed on both sides of a consolidation sheet is built. The gate 8 is formed so that it may be open for free passage to the space of both sides, and it makes both space inject resin simultaneously.

[0019] The example of the metal mold in the case of fabricating the composite molding object which has a weld line is shown in drawing 6. Generally, although impregnation resin produces a weld line in the place where that flow collided, the reinforcement of this portion falls remarkably compared with other portions. By joining the consolidation sheet by this invention to a part or all of a weld line, weld reinforcement can be improved substantially.

[0020] What carried out the laminating of the facing to the front face of a consolidation sheet, and was united with it in this invention may be used. The thermoplastics by which injection impregnation was carried out carries out melting unification with the facing of a consolidation sheet front face by arranging using the resin injected as facing, and the dissolving resin sheet, so that this facing may be on the resin side of a consolidation sheet. Moreover, the location of the gate which being [ of the location of the location of the gate and a consolidation sheet ] related of the gate becomes arbitrary since facing will control turbulence of fiber, if the laminating of the facing is carried out to the consolidation sheet, although the grain direction of a consolidation sheet must be considered as the floating direction of resin becoming settled with the location of the gate like the above-mentioned, and turbulence of fiber not arising by the floating, and

affects mold-goods appearance can be chosen freely.

[0021] Moreover, the thermoplastics by which impregnation is carried out to a consolidation sheet differs from the thermoplastics by which injection impregnation is carried out, in not carrying out heat welding, by using a nonwoven fabric etc. for facing, a nonwoven fabric fixes by the anchor effect to the poured-in thermoplastics, and the effect of carrying out cementation unification with a consolidation sheet arises. Moreover, if it is made for facing to appear in the outside surface of a composite molding object, the surface decoration effect will also become goes up.

[0022]

[Example] An example explains this invention below.

As shown in example 1 drawing 2 , the consolidation sheet was beforehand fixed to the interior of metal mold, impregnation restoration of the polypropylene resin was carried out into the mold using the injection molding machine, and the composite molding object was obtained. The configuration and process condition of a consolidation sheet are as follows.

configuration laminating sheet: -- thermoplastics; -- polypropylene resin reinforcement fiber ; Glass fiber fiber content ; thickness [ of a 70 % of the weight sheet ]; -- 180micro laminating configuration ; it becomes a right angle mutually about two sheets -- as -- laminate-molding condition mold \*\* ; 50-degree-C molding temperature ; 220-degree-C injection speed ; 2.8 mm/sec injection pressure ; 1400kg[/mm ] 2 dwelling ; the adhesive property of 500kg/mm<sup>2</sup> consequently a laminating sheet, and thermoplastics -- fitness -- and uniform The composite molding object which has rigidity was obtained. molding -- the center-section blank test piece was created mostly, and the Izod impact, the falling weight test, and the bending elastic modulus were measured. A result is shown in a table 1.

[0023] Except using the metal mold shown in example 2 drawing 4 , it fabricated on the same conditions as an example 1, and the composite molding object which connotes a laminating sheet in the center section was obtained. The test piece was created like the example 1 and the Izod impact, the falling weight test, and the bending elastic modulus were measured. A result is shown in a table 1.

[0024] The moldings which has a weld line W in the center as shown in drawing 7 using the metal mold which has the gate of 32 examples was fabricated. The process condition presupposed that it is the same as that of an example 1. As shown in drawing 7 from this moldings, the test piece T was created, and the weld reinforcement when making it pull strength applied to a weld portion was measured. The result was shown in a table 2.

[0025] Except not using the example of comparison 1 laminating sheet 1, it fabricated on the same conditions as an example 1, and the polypropylene moldings was obtained. The test piece was created like the example 1 and the Izod impact, the falling weight test, and the bending elastic modulus were measured. A result is shown in a table 1.

[0026] Except not using the example of comparison 2 laminating sheet 1, it fabricated on the same conditions as an example 3, and the polypropylene moldings which has weld in a center section was obtained. The test piece T was created like the example 3, and the weld reinforcement when making it pull strength applied to a weld portion was measured. The result was shown in a table 2.

[0027]

[A table 1]

表1 曲げ剛性及び曲げ弾性率

	実施例 1	実施例 2	比較例 1	試験法
アイゾット衝撃 ( $\text{kg} \cdot \text{cm} / \text{cm}$ )	50	46	9	ASTM D-256 $t=3.2\text{mm}$
落球試験 (1kg, $\phi 63.5$ , 高50cm)	窪みが生じるが、 破壊は起こらない。		破壊	JISK6718 に準ずる
曲げ弾性率( $\text{kg}/\text{mm}^2$ )	152	152	150	ASTM D-790

[0028]

[A table 2]

表2 ウェルド部引張り強度

	実施例 3	比較例 2	試験法
ウェルド部引張り強度 (kg/mm <sup>2</sup> )	1 0	1 . 5	ASTM D638

[0029]

[Effect of the Invention] As mentioned above, offer of the injection-molding object with which the compound unification of the thermoplastics sheet which contains consolidation fiber [ \*\*\*\* / an one direction ] by this invention, and the thermoplastics was carried out was attained so that clearly. Since the engine performance on the strength of such an injection-molding object is very high uniformly, it is high rigidity in a light-gage light weight.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the injection-molding object of this invention, and is drawing where the consolidation sheet expressed what was compounded with one moldings side.

[Drawing 2] It is drawing showing the metal mold for fabricating the injection-molding

object of drawing 1 .

[Drawing 3] It is the metal mold for fabricating the injection-molding object of this invention, and is drawing showing the thing from which it was made for the gate to become the center section of a moldings.

[Drawing 4] It is drawing showing the mode of the metal mold for fabricating the injection-molding object which has a consolidation sheet in the interior of thermoplastics.

[Drawing 5] It is drawing showing other modes of the metal mold for fabricating the injection-molding object which has a consolidation sheet in the interior of thermoplastics.

[Drawing 6] It is drawing showing the mode of the metal mold for fabricating an injection-molding object with a weld line.

[Drawing 7] It is drawing showing the injection-molding object of this invention with a weld line.

[Description of Notations]

1 Main Part of Moldings

2 Fin Gate Portion of Moldings

3 Consolidation Sheet

4 On the Other Hand, it is Metal Mold.

5 Another Side Metal Mold

6 Space

7 Vacuum Hole

8 Gate

W Weld line

T Test piece

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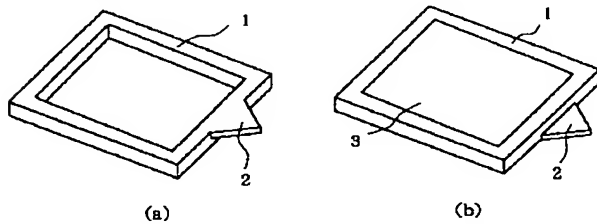
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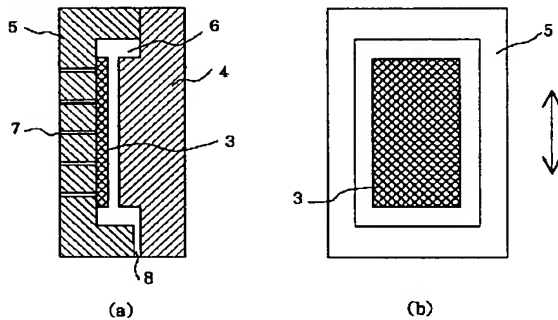
## DRAWINGS

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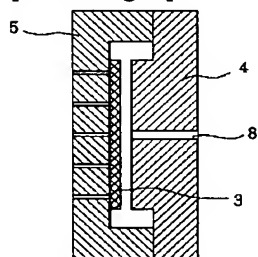
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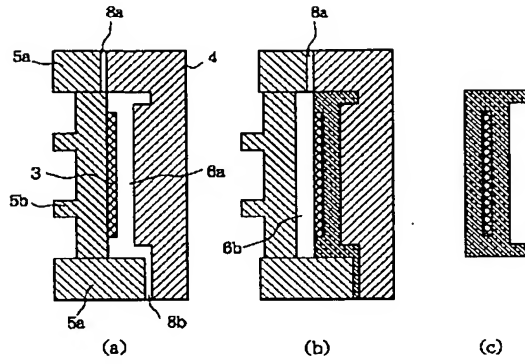
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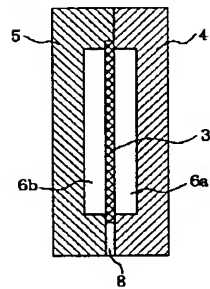
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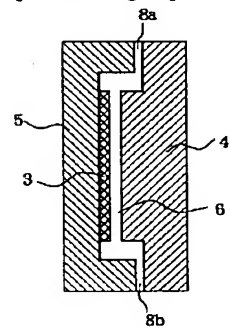
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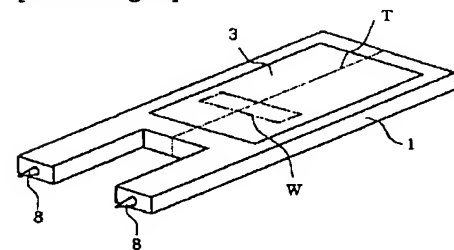
[Drawing 5]



[Drawing 6]



[Drawing 7]



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